[Buddha Series]

Course – B. Tech

Subject – Engg. chemistry (BAS 102/BAS-202)

Unit – I

Topic – Atomic and Molecular Structure.

By

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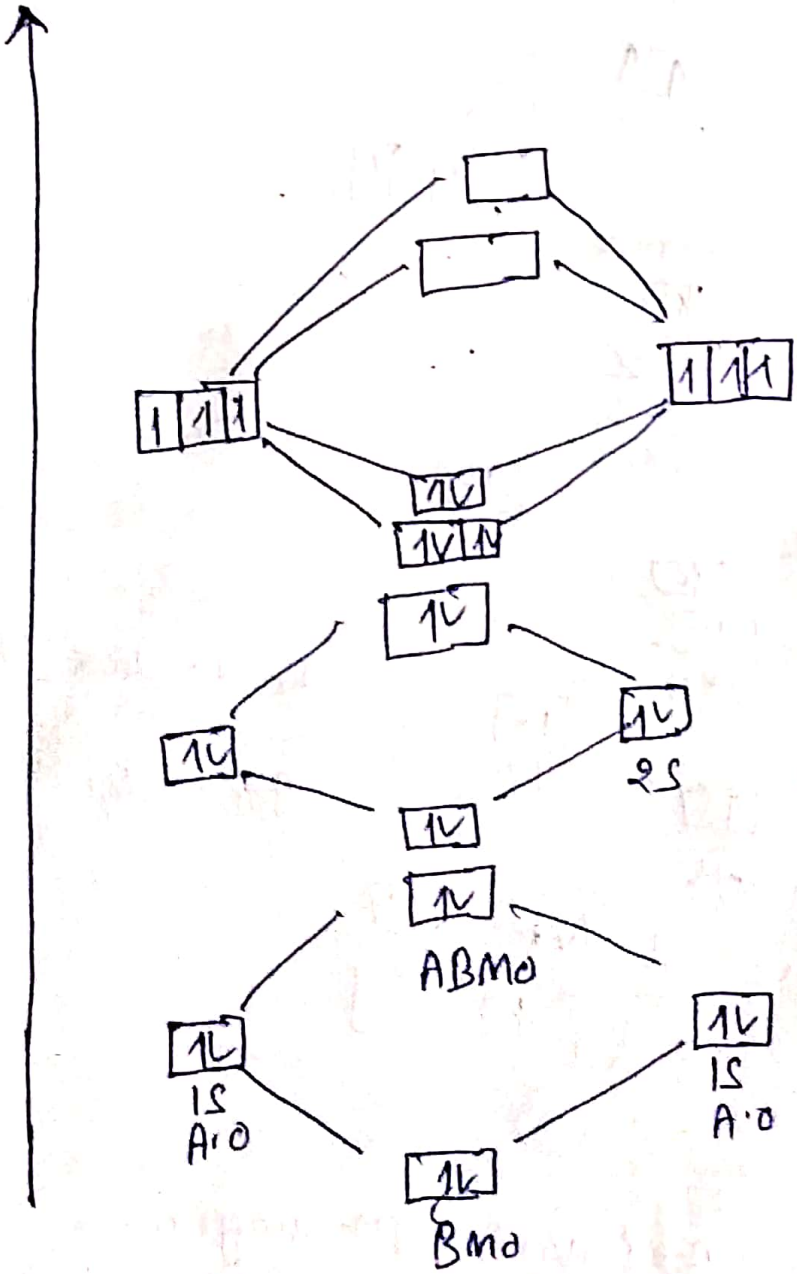
① Draw the molecular orbital diagram of N_2 molecule Give its bond order and magnetic behaviour.

Molecular orbital digram of N_2 Molecule.

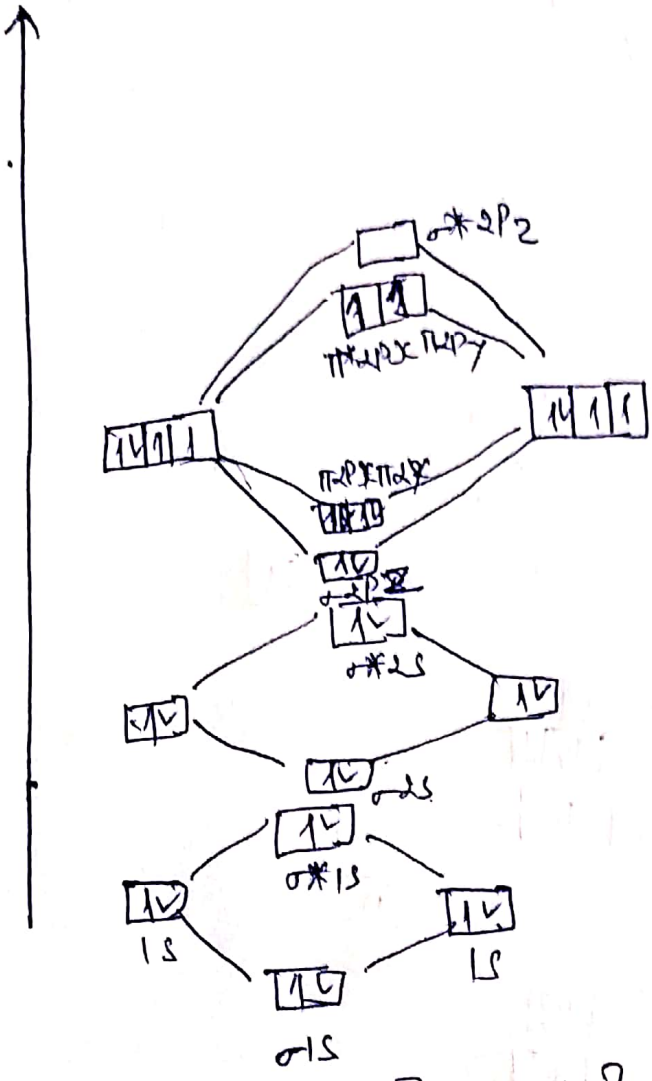
$_7N_2 - 1s^2 2s^2 2p^3$
$_7N - 1s^2 2s^2 2p^3$] 14



(2) Draw the M.O diagram of O_2 molecule and their magnetic behaviour (2009, 2017, 2019).

Molecular orbital diagram of O_2 molecule.

$_8O - 1s^2 2s^2 2p^4$] 16
$_8O - 1s^2 2s^2 2p^4$]



Bond order and Stability

Bond order $\propto \frac{1}{\text{Bond Length}}$

Bond order $= \frac{1}{2}[N_b - N_a]$
$= \frac{1}{2}[10 - 6]$
$= 2$

magnetic Behaviour- paramagnetic

Bond order of $N_2 = 3$ $F_2 = 1$ $NO = 2.5$
$O_2 = 2$ $CO = 3$ $NO^+ = 3$

(9) What are Liquid crystals, Give its classification and application also (2014)

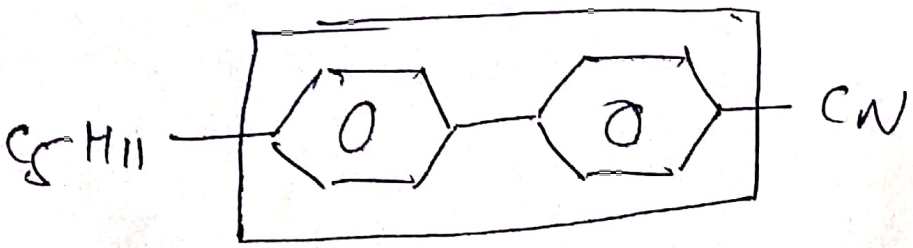
[Liquid crystaline state] (1)

Liquid crystals are substance that exhibit a phase of matter that have properties b/T liquid and phase of solid crystal. (Hazy qui)

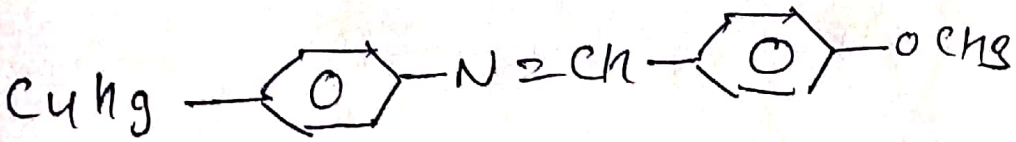
These phase have translucent or cloudy apperance. Liquid crystaline phase are also called mesomorphic phases.

Essential requirement for the L.C.

(1) Presence of carboxyl group at end
(2) molecule of anisotropic in nature.
(3) Absence of bulky functional group.
(4) presence of unsaturation
(5) Molecule have some rigidity in center and ends must be flexible



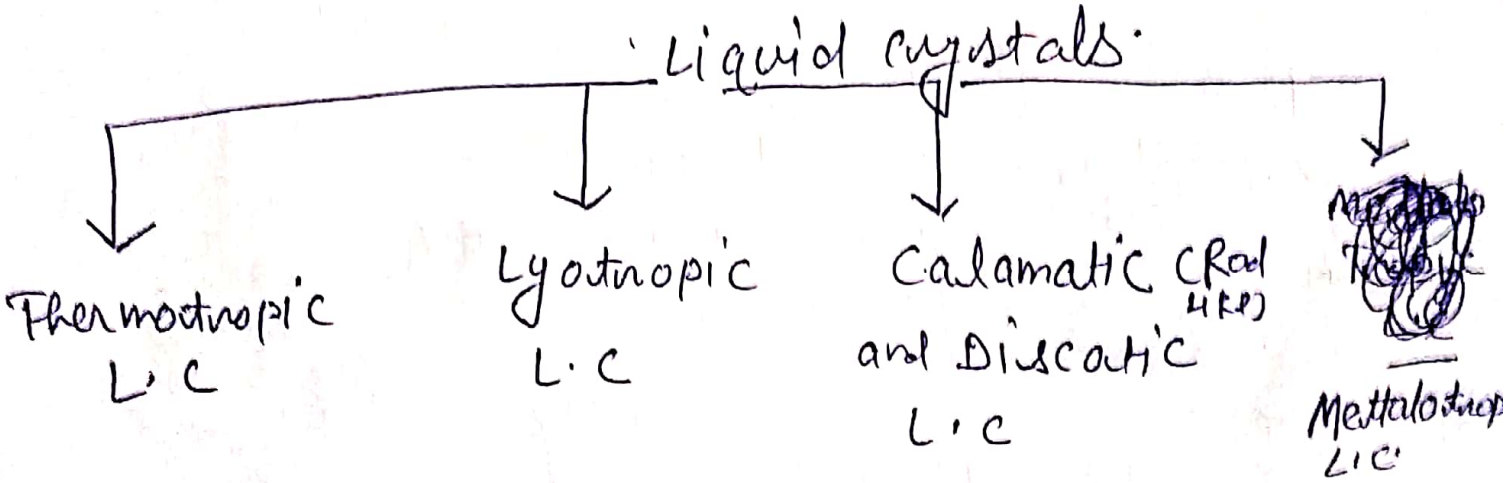
Regid Rod like part (Mesogen).



Molecule which form Liquid crystals.

1. cholesteral ester
2. phenyl benzoates
3. paraffins.
4. Glyco lipids
5. cellulos derivative.

classification of liquid crystal.



Application of Liquid crystal.

① Liquid crystal display (LCD). A LCD is a thin flat display device made up of many numbar of colours or monochrome in front of light source or reflector. LCD used in notebook, small computer, Light emmiting diode (LED). It is much thinner than cathode Ray tabel (CRT)

② Liquid crystal thermography = chiral nemahic or chloesteric L.C used for detecting tumars cancer in Human body by the method called thermography.

③ Gas liquid chromatography ⇒ L.C have property b/T crystalline solid and liquids so they are used in gas Liquid chromatography.

④ L.C are used as solvent for the study of anisotropic molecules by the method Spectroscopically.

⑤ L.C are used in making digitial thermometer

(4) Describe the structure and application of Graphite and Fullerenes. Explain the reason for electrical and Lubrication properties of Graphite (2023).

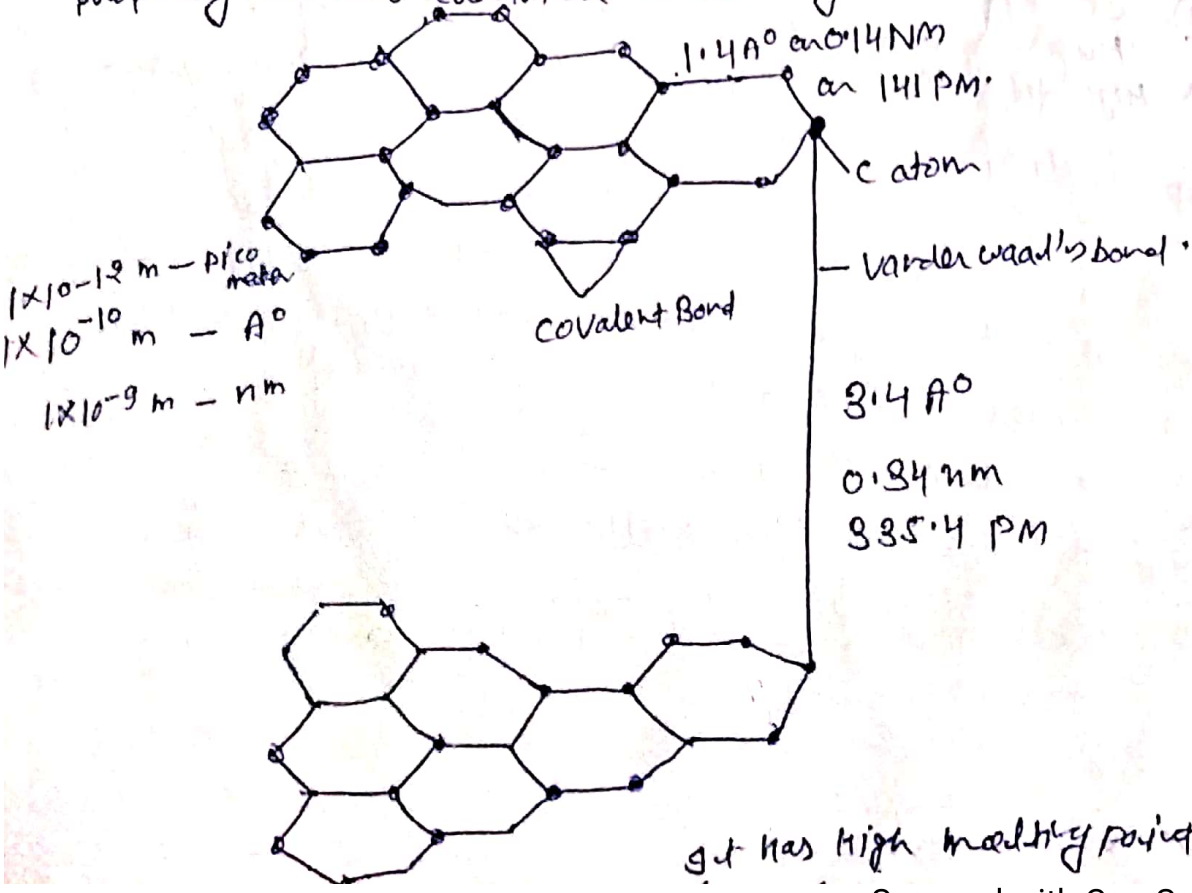
[Graphite]

Amorphous – coal
Cryst – Diamond, Graphite, Fullerene.

Graphite is Allotrops of carbon. In graphite atoms are arranged in layers. It is of two type α and β Graphite. It has sandwich like structure.

In graphite carbon atom is arranged in hexagon and hexagon form a plane. Each carbon atom in hexagon attached to only three carbon atom by covalent bond. The fourth e- is participating in a weak Vander waal's type of bonds between the layers. Graphite show sp2 hybridisation.

Due to presence of weak Vander waal's bond cleavage is facile which give excellent Lubricative property and also electrical conductivity to Graphite.



It has high melting point

Type of Graphite.

① α- Graphite - Hexagonal arrangment

ABAB Type arrangment

② β Type Graphite. It has Rhombohedral Arrangment.

ABCABC Type Arrangment

properties of Graphite.

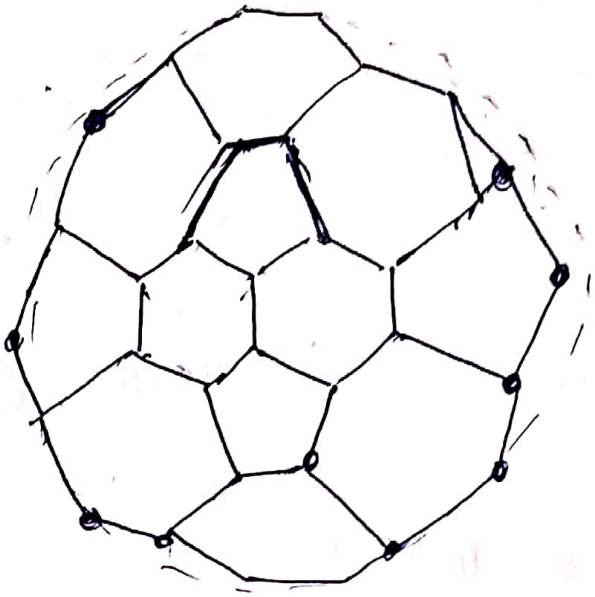
① It is gray colour crystalline solid
② It is soft and soapy in touch.
③ Good conduction of electricity.
④ It behave like solid Lubricant
⑤ High strength and good chemical stability.
⑥ High thermal conductivity low coefficient of thermal expansion.

Application - It is used in pencile lead.

② It is used in making moderator Rod.
③ As heating element for electric furnaces.
④ Electrode for welding ⑤ casting moulds for metal alloys and ceramics.
⑥ In Rocket Nozzels.
⑦ Electrodes in batteries.
⑧ In purification devices.

[Fullerenes]

Fullerenes is an allotrop of carbon. It was discovered by. H. Kroto and Richard Smalley and named after Richard Buckminister Fuller.



C60
C70
C80
C90
C100

Fullerene C60.

Structure – (1) It is hollow spherical Soccerball (football) like structure. so it is also called Bucky ball.

(2) The structure of fullerenes each Carbon atom is sp2 Hydridized and arranged in Hexagon and pentagon.

(3) It is represented by C60

(4) In one molecule of C60 there are 20 Hexagon and 12 pentagon.

(5) They are arranged in such a way that two pentagon never share their wall.

[Application of fullerenes]

① As super conductor - It can be used as super conductor when doped with alkali metals.

② Carbon nanotube (CNT) - It is used in making carbon nano tubes. Carbon fibers made from organic polymer are used to strengthen light weight high-tech material such as carbon/epoxy Resin used in golf clubs, tennis racquet.

③ It is used ——— detection of cancer cell and tubercles
Tuman cells in brain and Heart.

④ It is also used in oral nano medicines

⑤ used as catalyst and used as smart materials

(5) What are nano materials · Give its application in different field and explanation also (2024.

[Nanomaterials] (1)

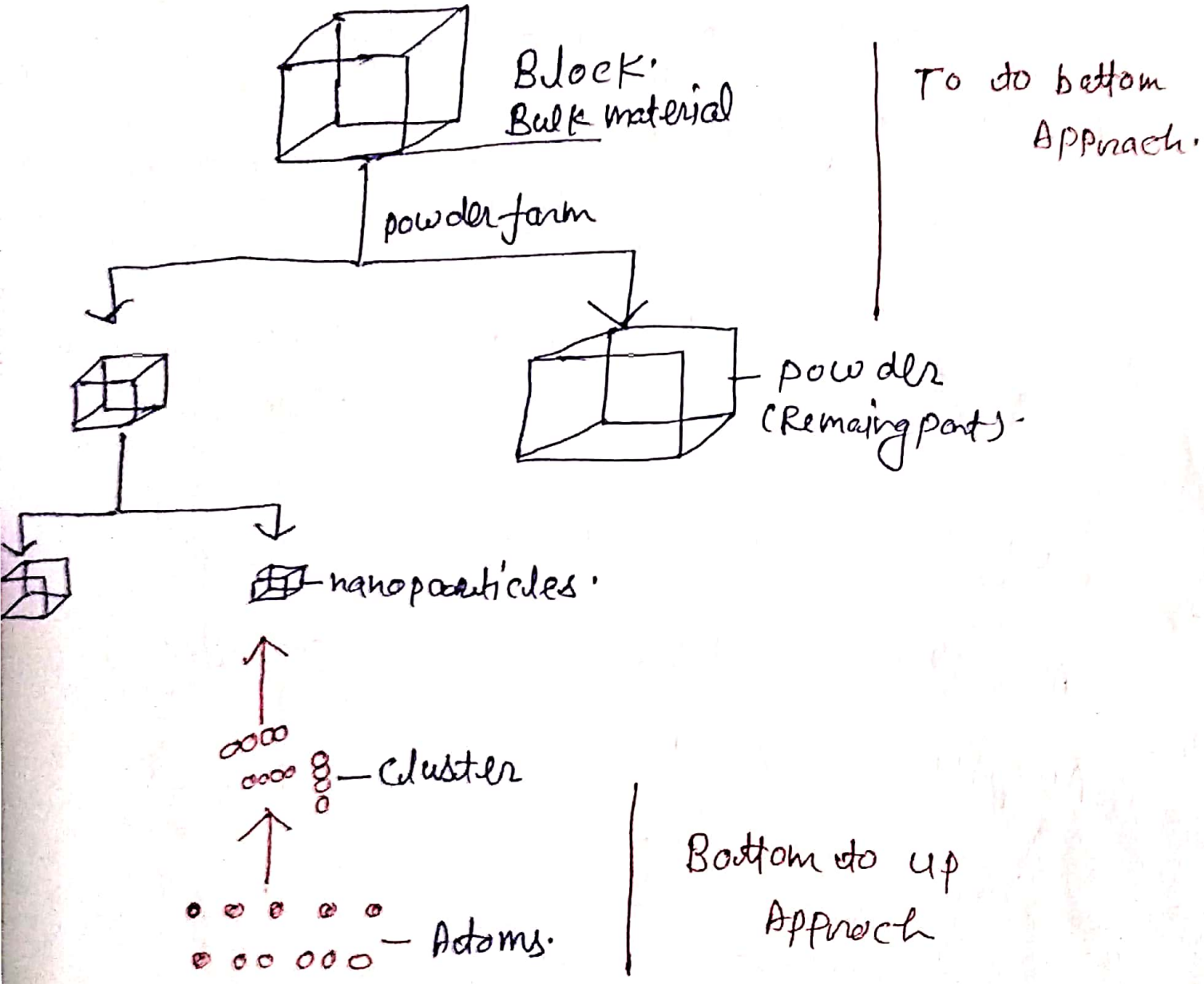
The Term nano originated from Greek word nanos means dwarf. The material which have particle size in between 1–100 nm.

Nanotechnology ⇒ The manipulation of matter on atomic & molecular scale.

	Simple properties	Prop. of nanomaterial
Si	Insulator	conductor / semi conductor.
Pt	Inert material	Catalyst.
Al	Stable	Combustable.
Au (gold)	melt 1065°c	300 °C.

Preperation of Nanomaterials.

1. Top down Approach
2. Bottom to up approach.



Application of Nanomaterials / Nanotechnology.

(1) In medical field. Some nanoparticles are developed that they deliver drug to specific type of cell which allow to direct treatment of those cell.

(2) Electronics - Due to nanotechnology reduce the size of transistors in integrated circuits.

~~Iron dio~~

(3) environment ⇒

(a) Iron nanoparticle cleaning organic solvents that are polluting ground H2O

(b) Ag nanoparticle reduced the production of biproduct in manufacturing propyline oxide.

(c) Silicon nanowires embedded in polymer resulted low cost but high efficiency solar cells.

(4) consumer product - 1) Ag nanoparticle is used in making odour resistant clothes.

(5) sports - Increasing strength of Tennis racquet by adding nanotubes.

Nanoparticle is used in manufacturing golf club shaft.

(5) What is Green chemistry. Give its 12 principle of Green chemistry. (2024)

[Green chemistry]

The practice of chemistry in a manner that maximise its benefits while eliminating or at least greatly reducing its adverse impact has come to be known as green chemistry.

The 12 principles of green chemistry as given by Anastas and Clark.

12 Principles of green chemistry.

1) Prevention
2) Atom economy
3) Less Hazardous chemical synthesis.
4) Designing Safer chemicals.
5) Safe Solvent
6) Design for energy efficiency.
7) Use of Renewable Feedstocks.
8) Reduce Derivatives.
9) catalysis.
10) Design for degradation
11) Real time analysis for pollution prevention
12) Safer chemistry for accident prevention.

(7) Give the conventional and green Method for the synthesis of paracetamal.

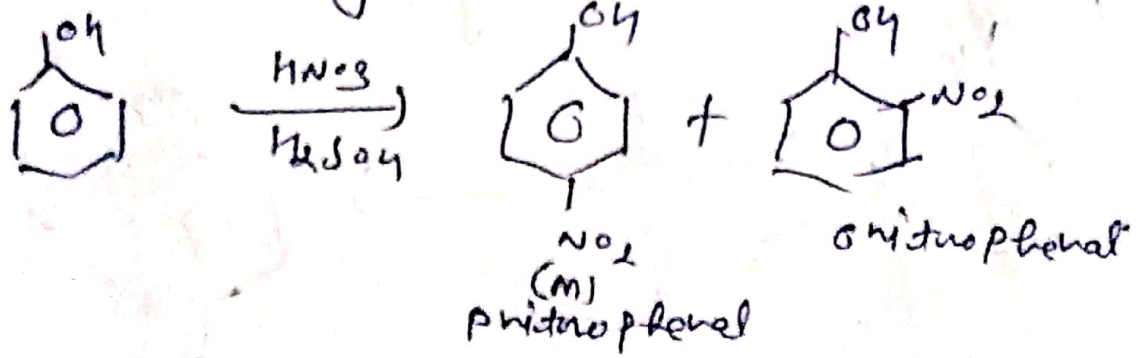
[Paracetamal] (2)

paracetamal is used to treat fever and reduce mild pain. It is antipyretic drug.

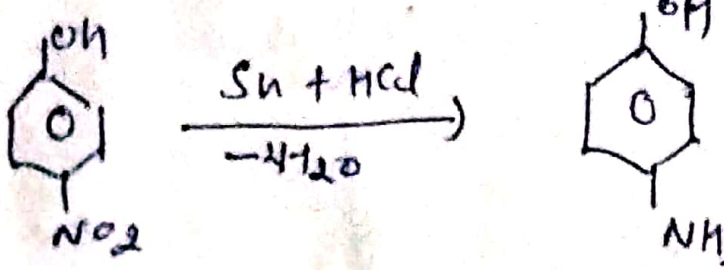
N-(4-hydroxyphenyl)ethanamide.

conventional method- It is synthesized from phenol in three step.

(1) Nitration of phenol.

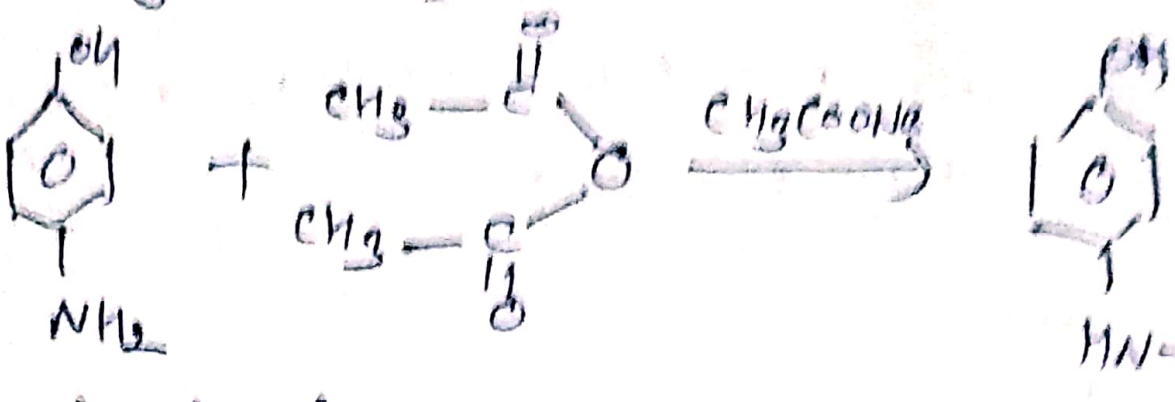


(2) Redtn of p nitrophenol.



p amino phenol.

③ Acetylation of p amino phenol.



p amino phenol

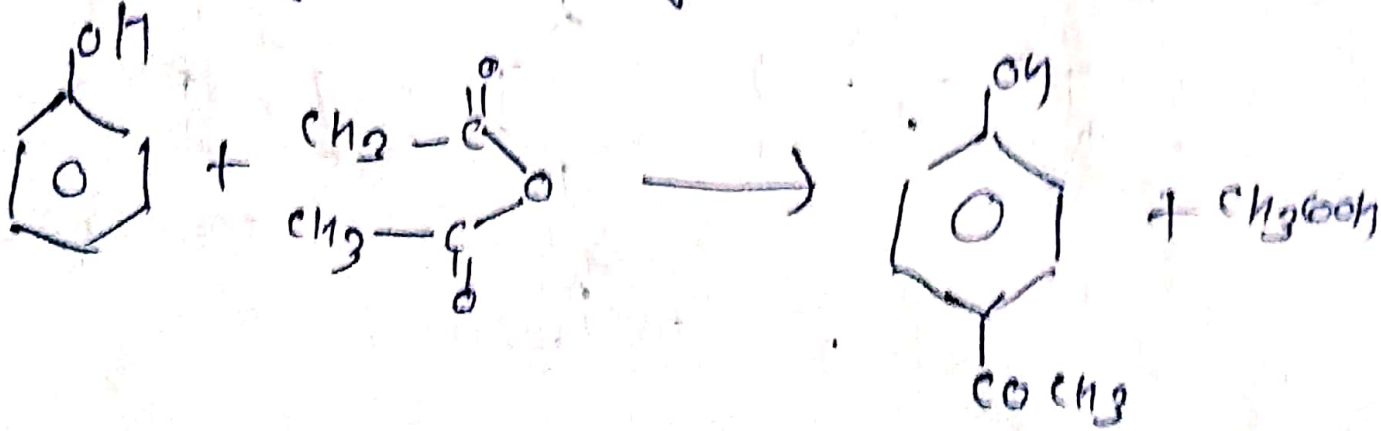
Aceta amino phenol
(paracetamol).

① Acid (mineral acid).
② Sn is used.

Green method.

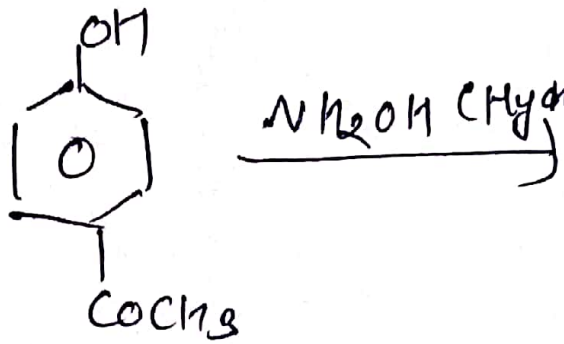
In this method starting material is phenol and it also involved 3 step.

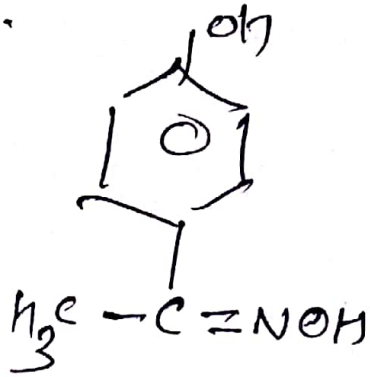
① Acetylation of phenol.



Paracetophenol.
(4 Hydroxy phenone)

(2) Step – Reach p acetophenol with hydroxyl amine to form Ketoxime. (3)

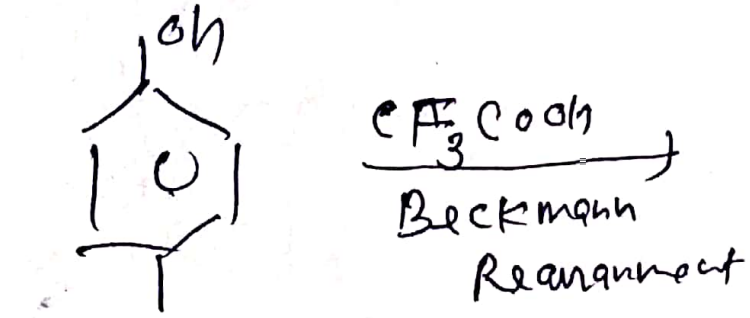


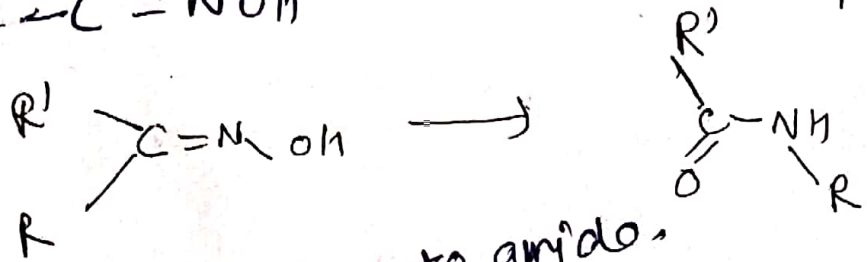


(oxime – class of nitrogen containing organic compound)

Ketoxime.

(3) oximes undergo Beckmann rearrangement to produce paracetamol.





Beckmann – oxime to amide.
in acedic condition.

Amide – Have carbonyl functional group which is linked to amine and Hydrocarbon